CLAIMS:

1. A fuel cell system comprising:

a fuel cell stack (1) comprising a plurality of fuel cells (2a, 2b) stacked in series;

wherein the fuel cells (2a, 2b) comprise a first fuel cell (2a) disposed in a center position of the fuel cell stack (1) with respect to a stacking direction of the fuel cells (2a, 2b), and a second fuel cell (2b) disposed in a position other than the center position, the second fuel cell (2b) being arranged to have a larger moisture absorption capacity than the first fuel cell (2a).

2. The fuel cell system as defined in Claim 1, wherein each of the fuel cells (2a, 2b) comprises an anode (26a) to which hydrogen is supplied, a cathode (26b) to which air containing oxygen is supplied, and a electrolyte membrane (20) formed of a moisture-absorbing material which conducts hydrogen ions from the anode (26a) to the cathode (26b), and the electrolyte membrane (20) of the second cell (2b) is formed to have a larger moisture absorption capacity than the electrolyte membrane (20) of the first cell (2a).

3. The fuel cell system as defined in Claim 1, wherein each of the fuel cells (2a, 2b) comprises an anode (26a) to which hydrogen is supplied, a cathode (26b) to which air containing oxygen is supplied, and a electrolyte membrane (20) formed of a moisture-absorbing material which conducts hydrogen ions from the anode (26a) to the cathode (26b), and the cathode (26b) of the second

cell (2b) is formed to have a larger moisture absorption capacity than the cathode (26b) of the first cell (2a).

4. The fuel cell system as defined in any one of Claim 1 through Claim 3, wherein the fuel cell system further comprises a humidifier (7) which humidifies air supplied to the fuel cells (2a, 2b) and a programmable controller (11) programmed to control the humidifier (7) to suppress the humidification of the air supplied to the fuel cells (2a, 2b) before the fuel cell system stops operating (S3).

5. The fuel cell system as defined in Claim 4, wherein the fuel cell system further comprises a sensor (12a, 12b) which detects a parameter related to the moisture content of the fuel cells (2a, 2b), and the controller (11) is further programmed to determine the moisture content of the fuel cells (2a, 2b) from the parameter (S2), and to make the humidification suppression time longer, the larger is the moisture content of the fuel cells (2a, 2b) (S3).

6. The fuel cell system as defined in Claim 4, wherein the fuel cell system further comprises a humidifier (6) which humidifies hydrogen supplied to the fuel cells (2a, 2b), and the controller (11) is further programmed to control the humidifier (6) to suppress the humidification of the hydrogen supplied to the fuel cells (2a, 2b) before the fuel cell system stops operating (S3).

7. The fuel cell system as defined in any one of Claim 1 through Claim 3,

wherein the fuel cell system further comprises a humidifier (7) which humidifies air supplied to the fuel cells (2a, 2b), a sensor (17) which detects a temperature of the fuel cell stack (1) and a programmable controller (11) which controls the humidifier (7), wherein the controller (11) is programmed to supply air to the fuel cells (2a, 2b) while suppressing humidification of air by the humidifier (7), when the temperature of the fuel cell stack (1) reaches a predetermined low temperature region after the fuel cell system stops operating.

8. The fuel cell system as defined in any one of Claim 1 through Claim 3, wherein the fuel cell system further comprises an electrical circuit (8) which adjusts an output current of the fuel cell stack (1), a sensor (17) which detects a temperature of the fuel cell stack (1) and a programmable controller (11) programmed to control the electrical circuit (8) to maintain the output current of the fuel cell stack (1) at a constant current when the temperature of the fuel cell stack (1) is in a predetermined low temperature region when the fuel cell system starts up (S2, S13).

9. The fuel cell system as defined in any one of Claim 1 through Claim 3, wherein the fuel cell system further comprises a purge device (14c, 14d) which purges residual moisture in the second cell (2b), a sensor (17) which detects a temperature of the fuel cell stack (1) and a programmable controller (11) programmed to operate the purge device (14a, 14d) so that the moisture content of the second cell (2b) is less than the moisture content of the first cell (2a) when the temperature of the fuel cell stack (1) is in a predetermined

low temperature region (S30).

10. The fuel cell system as defined in Claim 9, wherein the purge device (14c, 14d) is a device which adjusts one of a pressure, a flowrate, a humidification degree, a temperature and a supply time of the air supply to the second cell (2b).

11. The fuel cell system as defined in Claim 1, wherein the fuel cell system further comprises a first humidifier (7a) which humidifies air supplied to the first cell (2a), a second humidifier (7b) which humidifies air supplied to the second cell (2b), a sensor (17, 28) which detects a temperature of the fuel cell stack (1) and a programmable controller (11) programmed to control the first humidifier (7a) and second humidifier (7b) so that the humidity of the air supplied to the second cell (2b) is higher than the humidity of the air supplied to the first cell (2a) when the temperature of the fuel cell stack (1) is equal to or higher than a predetermined temperature when the fuel cell system starts up (S21).

12. The fuel cell system as defined in any one of Claim 1 through Claim 3, wherein the fuel cell system further comprises a first humidifier (7a) which humidifies air supplied to the first cell (2a), a second humidifier (7b) which humidifies air supplied to the second cell (2b), a voltage sensor (13) which detects an output voltage of the fuel cell stack (1) and a programmable controller (11) programmed to control the first humidifier (7a) and second

humidifier (7b) so that the humidity of the air supplied to the first cell (2a) is higher than the humidity of the air supplied to the second cell (2b) when the output voltage of the fuel cell stack (1) is equal to or greater than a predetermined voltage (S22, S24).

13. The fuel cell system as defined in any one of Claim 1 through Claim 3, wherein the fuel cell system further comprises a first humidifier (7a) which humidifies air supplied to the first cell (2a), a second humidifier (7b) which humidifies air supplied to the second cell (2b) and a programmable controller (11) programmed to control the first humidifier (7a) and second humidifier (7b) to decrease the humidity of the air supplied to both the first cell (2a) and second cell (2b) at a predetermined interval in a state where the humidity of the air supplied to the second cell (2b) is lower than the humidity of the air supplied to the first cell (2a) (S33).

14. A fuel cell stack (1) generating electric power through electrochemical reaction of hydrogen and oxygen, comprising:

a plurality of fuel cells (2a, 2b) stacked in series, each of the fuel cells (2a, 2b) comprising an anode (26a) to which hydrogen is supplied, a cathode (26b) to which air containing oxygen is supplied, and an electrolyte membrane (20) which conducts hydrogen ions from the anode (26a) to the cathode (26b);

wherein the fuel cells (2a, 2b) comprise a first cell (2a) disposed in a center position of the fuel cell stack (1) with respect to a stacking direction of the fuel cells (2a, 2b), and a second cell (2b) disposed in a position other than

the center position, the second cell (2b) being arranged to have a larger moisture absorption capacity than the first cell (2a).

15. The fuel cell stack as defined in Claim 14, wherein the electrolyte membrane (20) comprises a moisture-absorbing material, and the electrolyte membrane (20) of the second cell (2b) has a larger thickness in the stacking direction than the electrolyte membrane (20) of the first cell (2a).

16. The fuel cell stack as defined in Claim 14, wherein the electrolyte membrane (20) comprises a moisture-absorbing material, and the electrolyte membrane (20) of the second cell (2b) has a larger ion exchange group equivalent weight than the electrolyte membrane (20) of the first cell (2a).

17. The fuel cell stack as defined in any one of Claim 14 through Claim 16, wherein the second cell (2b) comprises a substrate material, and a moisture-absorbing material mixed with the substrate material.

18. The fuel cell stack as defined in Claim 17, wherein the moisture-absorbing material is a material selected from a group comprising hygroscopic inorganic porous particle moisture-absorbing resins comprising silica gel, synthetic zeolite, alumina gel, titania gel, zirconia gel, yttria gel, tin oxide and tungsten oxide.

19. The fuel cell stack as defined in Claim 17, wherein the moisture-absorbing material is a material selected from a group comprising a crosslinked polyacrylate,

starch-acrylate graft copolymer cross-linked material, Poval polymer resin, polyacrylonitrile polymer resin and carboxymethylcellulose polymer resin.

20. The fuel cell stack as defined in Claim 17, wherein the substrate material is the electrolyte membrane (20) of the second cell (2b), and the moisture-absorbing material is mixed with the electrolyte membrane (20) within a weight range of 0.01 % to 30 % relative to a weight of the electrolyte membrane (20).

21. The fuel cell stack as defined in Claim 17, wherein the cathode (26b) comprises a catalyst layer (21) in contact with the electrolyte membrane (20) and a cathode gas diffusion layer (22) which diffuses oxygen in the air into the catalyst layer (21), the substrate material is the cathode gas diffusion layer (22) of the second cell (2b), and the moisture-absorbing material is mixed with the cathode gas diffusion layer (22) within a weight range of 0.01 % to 30 % relative to a weight of the cathode gas diffusion layer (22) of the second cell (2b).

22. The fuel cell stack as defined in any one of Claim 14 through Claim 16, wherein the cathode (26b) comprises a catalyst layer (21) in contact with the electrolyte membrane (20) and a cathode gas diffusion layer (22) formed of a moisture-adsorbing material which diffuses oxygen in the air into the catalyst layer (21), and the cathode gas diffusion layer (22) of the second cell (2b) has a larger thickness in the stacking direction than the cathode gas diffusion layer

(22) of the first cell (2a).

23. The fuel cell stack as defined in any one of Claim 14 through Claim 16, wherein the cathode (26b) comprises a catalyst layer (21) in contact with the electrolyte membrane (20) and a cathode gas diffusion layer (22) formed of a moisture-adsorbing material which diffuses oxygen in the air into the catalyst layer (21), and the cathode gas diffusion layer (22) of the second cell (2b) has a larger specific surface than the cathode gas diffusion layer (22) of the first cell (2a).

24. The fuel cell stack as defined in any one of Claim 14 through Claim 16, wherein the anode (26a), the cathode (26b) and the electrolyte membrane (20) are formed of a one-piece membrane electrode assembly (3) coated with a polymer solution, and the membrane electrode assembly (3) of the second cell (2b) has a larger polymer solution coating amount than the membrane electrode assembly (3) of the first cell (2a).

25. The fuel cell system as defined in Claim 24, wherein the polymer solution contains a perfluorocarbon sulfonic acid.

26. The fuel cell system as defined in any one of Claim 14 through Claim 16, wherein the cathode (26b) comprises a catalyst layer (21) in contact with the electrolyte membrane (20) and a cathode gas diffusion layer (22) with numerous pores which diffuse oxygen in the air into the catalyst layer (21), and the

pores of the cathode gas diffusion layer (22) of the second cell (2b) have a larger diameter than the pores of the cathode gas diffusion layer (22) of the first cell (2a).

27. The fuel cell system as defined in any one of Claim 14 through Claim 16, wherein the cathode (26b) comprises a catalyst layer (21) in contact with the electrolyte membrane (20) and a cathode gas diffusion layer (22) which diffuses oxygen in the air into the catalyst layer (21), and the cathode gas diffusion layer (22) of the second cell (2b) is formed of a material having a larger contact angle with moisture than the cathode gas diffusion layer (22) of the first cell (2a).

28. The fuel cell stack as defined in any one of Claim 14 through Claim 16, wherein the cathode (26b) comprises a catalyst layer (21) in contact with the electrolyte membrane (20) and a cathode gas diffusion layer (22) which diffuses oxygen in the air into the catalyst layer (21), the cathode gas diffusion layer (22) comprising carbon paper coated with moisture repelling material, and the carbon paper of the cathode gas diffusion layer (22) of the second cell (2b) has a larger amount of moisture repelling material than the carbon paper of the cathode gas diffusion layer (22) of the first cell (2a).

29. The fuel cell system as defined in any one of Claim 14 through Claim 16, wherein the fuel cell stack (1) comprises plural end cells (2b) which have a progressively increasing moisture-absorbing capacity with increasing distance

from the center cell (2a).

30. The fuel cell stack as defined in any one of Claim 14 through Claim 16, wherein the cathode (26b) comprises a catalyst layer (21) in contact with the electrolyte membrane (20), and the catalyst layer (21) of the second cell (2b) has a larger thickness in the stacking direction than the catalyst layer (21) of the first cell (2a).

31. The fuel cell stack as defined in any one of Claim 14 through Claim 16, wherein the cathode (26b) comprises a catalyst layer (21) in contact with the electrolyte membrane (20), and the catalyst layer (21) of the second cell (2b) has a larger specific surface than the catalyst layer (21) of the first cell (2a).

32. A fuel cell stack (1) which generates power by an electrochemical reaction between hydrogen and oxygen, comprising:

a plurality of fuel cells (2a, 2b) stacked in series, each of the fuel cells (2a, 2b) comprising an electrode (26a, 26b) and a gas passage (24, 25) facing the electrode (26a, 26b);

wherein the fuel cells (2a, 2b) comprise a first cell (2a) disposed in a center position of the fuel cell stack (1) in the stacking direction of the fuel cells (2a, 2b), and a second cell (2b) disposed in a position other than the first cell (2a), and the gas passage (24, 25) of the second cell (2b) has a larger cross-sectional area than the gas passage (24, 25) of the first cell (2a).

33. The fuel cell stack (1) as defined in Claim 32, wherein a gas supply flowrate to the gas passage (24. 25) of the second cell (2b) is set to be larger than a gas supply flowrate to the gas passage (24, 25) of the first cell (2a).